Air Pollution and Kansas Weather

Because of the state's geographical location in the middle of the country, Kansans experience four distinct seasons. Cold winters and hot, dry summers are the norms for the state. The other constant in Kansas weather is the wind.

Kansas ranks high in the nation in average daily wind speed. In 2003, the average wind speed across the state was a little more than 11mph. The predominant wind direction was from the south. These factors combine to affect the two major areas of air quality concern in the state, ozone and particulate matter.

The air pollution meteorology problem is a two-way street. The presence of pollution in the atmosphere may affect the weather and climate. At the same time, the meteorological conditions greatly affect the concentration of pollutants at a particular location, as well as the rate in which they are distributed throughout the atmosphere.

The ground level ozone or smog problem develops in Kansas during the period from April through October. Ozone is formed readily in the atmosphere by the reaction of volatile organic compounds (VOC) and oxides of nitrogen (NO_X) in the presence of heat and sunlight, which are most abundant in the summer months.

Kansas tends to see ozone episodes in the summer when high pressure systems stall over the area which leads to cloudless skies, high temperatures and light winds. Another element of these high-pressure systems that contribute to pollution problems is the development of upper air inversions. This will typically "cap" the atmosphere above the surface and not allow the air to mix and distribute pollutants. Therefore, pollution concentrations may continue to increase near the ground from numerous pollution sources since the air is not mixing within and above the inversion layer.

The other pollutant of concern is particulate matter (PM). Kansas has a long history of particulate matter problems caused by our weather. The Great Dust Bowl of the 1930's was caused, in part, by many months of minimal rainfall and high winds. This natural source of PM pollution, although not as bad as in the 1930's, is still a concern today as varying weather conditions across the state from year to year cause soil to be carried into the air and create health problems for citizens of Kansas.

Processes that have been initiated by humans generate another source of PM pollution. These particles may be emitted directly by a source or formed in the atmosphere by the changing of gaseous elements. Meteorological conditions also affect how these man-made sources of PM form and disperse. One factor that is common in Kansas that can lead to high pollution episodes is a surface inversion. Like upper air inversions, warmer air just above the surface of the earth forms a surface inversion and caps all pollutants below it. These inversions are mainly caused by the faster loss of heat from the surface than the air directly above it.

In Kansas, surface inversions are more common in the winter months, but can occur during any season and lead to pollution problems. The illustration below shows a simplified version of how a surface inversion would appear in a temperature profile of the atmosphere. The illustration below shows how the warm air aloft can trap the pollution at the surface.

These meteorological factors continue to make air pollution episodes a reality in Kansas and drive home the importance that weather plays in the lives of all Kansans.